

Posterior segment eye diseases: prevalence, pattern, and attribution to visual impairment among adult saudi population

Posterior segment eyed diseases in Saudi adults

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Abstract

Aim: In this study, we aimed to investigate the prevalence and pattern of posterior segment eye disease (PSEDs) and their attribution to visual impairment (VI) in Saudi adults of Arar city, Saudi Arabia. **Material and Method:** Prevalence and pattern of PSEDs were studied through ophthalmological evaluation including B-scan ultrasonography on 956 participants from Arar city. **Results:** The prevalence of PSEDs in the current study was 10.7%. Diabetic retinopathy (DR) was the commonest pathology found in 64 (6.7%) participants. Age-related macular degeneration (ARMD), optic atrophy (OA) and retinal detachment (RD) were found in 19 (2%), 16 (1.7%) and 10 (1%) cases respectively. Glaucoma was the commonest cause of OA found in 50% of cases. DR and high myopia were found to be the underlying cause in about 50% of RD cases. Vitreous hemorrhages in association with DR, ARMD, and RD were found in 39 (4%) cases. The current study revealed that DR was the commonest PSED diagnosed in cases of VI. **Discussion:** These data highlight the magnitude of the PSEDs as the causes of visual impairment and encourage proper healthcare planning to reduce the burden of the posterior segment eye diseases.

Keywords

Blindness; Diabetic Retinopathy; Low Vision; Macular Degeneration; Optic Atrophy; Posterior Segment Eye Diseases; Retinal Detachment; Visual Impairment; Vitreous Hemorrhage

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Introduction

Posterior segment eye diseases (PSEDs) are commonly defined as diseases of the retina, choroid and optic nerve. They primarily include glaucoma, age-related macular degeneration (AMD) and diabetic retinopathy (DR) [1]. PSEDs differ from the anterior segment eye diseases like cataract and refractive errors in terms of modalities for their prevention and treatment. Most of the posterior segment disorders are difficult to treat and established visual loss is difficult to reverse as for many PSEDs there is no 'curative' treatment [2]. Unfortunately, the infrastructure required to detect and treat PSED is very costly and often unavailable in most eye care centers [3]. In addition, highly skilled staff required for conducting posterior segment surgical interventions is not commonly available in most of the medical centers and hospitals.

Optic atrophy (OA) is the final common morphologic endpoint of any disease process that causes axon degeneration in the retinogeniculate pathway. Glaucoma is a common treatable cause of OA. Hence, medical and/or surgical intervention in cases of glaucoma can slow its progression and lower the risk of further sight loss caused by optic atrophy [4]. For diabetic retinopathy, proper control of diabetes mellitus, intravitreal anti-VEGF injections, retinal laser photocoagulation or even vitreoretinal surgery can improve the outcome and prevent vision loss [5]. However, PSEDs like age-related macular degeneration (AMD) have no definitive treatment, although intravitreal injections and laser therapy is available for wet type of AMD. Antioxidants have shown some evidence of risk reduction in progression of subtypes of AMD [6], but not prevention of AMD [7] and on the other hand, it may be prohibitively expensive.

In most countries, health programs are largely focused on the treatment of anterior segment diseases, such as cataract and refractive errors (RE), as it alone causes the majority of blindness and is highly curable through cataract surgery or RE corrections. The problem of PSED has not been focused to date in the national current health programs due to a lack of data on its pattern and prevalence. Prevalence of PSEDs was estimated in previous studies to range from 20% to 67% [8]. However, except for a study on diabetic retinopathy, the prevalence of PSEDs has not yet been broadly estimated in Saudi Arabia.

The proposed study aims to establish the magnitude of visual impairment and blindness attributed to PSEDs in Arar city through screening for ophthalmic disorders in the general population and identification of the PSEDs among the studied population. These data are necessary for better health service planning in Arar in the future, to improve the early diagnosis and management of cases of PSEDs.

Material and Method

Ethical issues: This study was conducted in Arar city, which is the capital of the Northern border region of the Kingdom of Saudi Arabia during the period from July 2017 to November 2017. The current research proposal and design were approved by the university local ethics committee. Only Saudi persons aged 12 years and above were included in the current study. Free informed consents were obtained from 956 participants or their legal guardian (if the age was below 16 years) who had agreed to participate in this study. Confidentiality and malefi-

cence ethical principles were considered in all steps and cases which need further care were referred to the proper health facilities for medical or surgical treatment.

Study design: Free eye camps were organized for the purpose of general screening. After obtaining free informed consent from each participant, personal data and detailed history were collected. Then all participants were examined by ophthalmologists. Finger prick Random blood glucose (RBG) was estimated by calibrated glucometer by the accompanying well-trained nurses. Diabetes mellitus (DM) was considered if participants had a history of DM or RBG was >200 mg%. Diagnosed known diabetic patients under the treatment were considered as poorly controlled if RBG was >200 mg%. The examination protocol included visual acuity (VA) testing without correction, refraction, slit lamp examination, examination of the pupil, tonometry, and ophthalmoscopy on all subjects. Secondly, corrected VA retesting and dilated fundus examination was done on a subject who showed low vision or blindness. B-scan ultrasonography was performed on all cases where the fundus could not be visualized. Optical coherence tomography (OCT) and fundus fluorescein angiography (FFA) was performed only when required. For DR, the study followed the Rapid Assessment for Avoidable Blindness and Diabetic Retinopathy (RAAB+DR) technique, which was developed by the International Centre for Eye Health, London School of Hygiene and Tropical Medicine (ICEH-LSHTM), London, United Kingdom. Among diabetic patients, DR was estimated following Scottish DR grading system. In the event of non-visualization of fundus, alternative re-evaluation examination at Arar Central Hospital was arranged for those participants. Cases of DR were followed up according to the recommendation of the Scottish DR grading system. In addition, cases of unilateral diminution of visual acuity (DOVA) were further examined to study the cause of their decreased vision. Data were collected for further statistical analysis.

Low vision and blindness in the current study were classified according to the World Health Organization (WHO) definition of visual impairment. Low vision was considered when the best corrected visual acuity (BCVA) in the better-seeing eye was less than 20/60 but not less than 20/400 and blindness when BCVA was less than 20/400. Unilateral diminution of vision (UDOVA) was considered when BCVA in one eye was $< 20/30$ with normal VA of the other eye. Visual acuity better than 20/30 in the best-corrected eye, was considered as normal VA.

Statistical analysis: Prevalence of VI and different PSEDs in the studied population was calculated as the number of cases divided by the number of the studied population. Newcomb (1998) [9] formula was used to estimate the 95% confidence intervals. For nominal association, Chi-Square test was used. All statistical procedures were conducted by Prism7 (Graph Pad Software Inc., San Diego, CA). Significance was estimated with p-values <0.05 .

Results

Demographic data of the studied subjects: Nine hundred and fifty-six Saudi persons were consented to participate in the current study. The ages of the studied subjects ranged from 12

to 65 years (43.6 ± 15.2). Regarding genders, 498 (52%) were males and 458 (48%) were females participated in the study. The participants were classified in 4 age groups as shown in **Table 1**. The studied groups were properly cross-matched without a significant difference between the age groups in relation to genders (p=0.7).

Regarding VA testing without correction, 744 subjects (77.8%) showed normal VA in both eyes while the remaining cases showed unilateral or bilateral diminution of their visual acuity (DOVA). On further examination with correction, only 81 (8.4%) cases were found to have VI and their level of VI was graded following WHO classification into a low vision and blind cases, while only 103 (10.8%) cases had shown unilateral DOVA. The prevalence of different degrees of VI and unilateral DOVA in relation to ages and genders of the studied population is shown in **Table 1**.

Regarding genders of the studied subjects, there was no significant difference between both genders in the prevalence of VI [p=0.534, X²(df)= 3.145,4]. While there was significant difference in VI distribution among the different age groups with more prevalence among elderly [p<0.0001, X²(df) = 96.58,12].

Regarding DM data, 234 (24.47%) participants were considered as diabetics (142 males and 92 were females) from whom only 156 (66.6%) were aware of having diabetes and were under therapeutic control.

Prevalence of the PSEDs: Posterior segment causes of VI and DOVA are shown in **Table 2**. Most of the causes of VI and DOVA were mainly attributed to the anterior segment problems with cataract and refractive errors representing the major part. In addition, PSEDs in relation to ages and genders in the studied population are shown in **Table 3**.

Regarding posterior segment causes of VI, diabetic retinopathy was the commonest and was found in 64 (6.7%) cases of the studied population. From these participants, retinal burns due to LASER therapy for DR were found in 2 cases. Prevalence and grading of DR among the screened diabetics are shown in **Table 4**.

The second commonest posterior segment cause of VI was AMD, which was found in 19 (2%) participants and optic atro-

Table 2. Prevalence of PSEDs as causes of visual impairment and blindness.

Site of pathology	Low vision	Blindness	Uni. DOVA	Uni. B/N	Totals
	64 (100%)	17 (100%)	103 (100%)	18 (100%)	202 (100%)
Anterior segment	26 (40.6%)	3 (17.4%)	62 (60.2%)	2 (11.1%)	93 (46%)
PSEDs in association with other anterior segment problems					
DR	6 (9.3%)	4 (23.2%)	12 (11.6%)	3 (16.6%)	25 (12.4%)
ARMD	4 (6.2%)	2 (11.6%)		2 (11.1%)	8 (3.9%)
OA	2(3.1%)	1 (5.8%)		2(11.1%)	5 (2.5%)
RD	1 (1.5%)	1 (5.8%)		2(11.1%)	4 (2%)
PSEDs alone					
DR	19 (29.6)	1 (5.8%)	19 (18.4%)	-	39 (19.3%)
ARMD	3 (3.6%)	3 (17.4%)	5 (4.8%)	-	11 (5.4%)
OA	2(3.1%)	1 (5.8%)	5 (4.8%)	3(16.6%)	11 (5.4%)
RD	1 (1.5%)	1 (5.8%)	-	3 (16.6%)	5 (2.5%)
Amblyopia				1 (5.5%)	1(0.5%)

Abbreviations: ARMD: Age-related macular degeneration; B/N: Blindness; DOVA: Diminution of visual acuity; DR: Diabetic retinopathy; OA: Optic atrophy; PSED: Posterior segment eye disease; RD: Retinal detachment.

Table 3. Prevalence and grading of DR following Scottish DR Grading Scheme.

Grades	Males	Females	p-value
	142 (100%)	92 (100%)	
R0 (No retinopathy)	113 (79.5%)	57(61.9%)	X ² (df)= 8.898,4
R1 (Mild retinopathy)	13 (9.15%)	17 (18.5%)	
R2 (Observable retinopathy)	9 (6.3%)	10 (10.8%)	
R3 (Referable retinopathy)	4 (2.8%)	4 (4.3%)	
R4 (Proliferative retinopathy)	3(2.1%)	4 (4.3%)	

phy was found to be the third commonest cause as it was found only in 16 (1.6%) subjects. Nine (56.25%) cases of optic atrophy (OA) gave a history of glaucoma, while 3 (18.75%) cases gave history suggesting hereditary OA. Other 3 (18.75%) cases gave a history of intracranial tumors, while the remaining one case (6.25%) of OA was firstly discovered and in need for further evaluation.

Retinal detachment was found in 10 (1%) cases of the studied population. Three cases had a prolonged history of uncontrolled diabetes mellitus, 2 cases showed high myopia and 1 case suffered RD following cataract surgery. In addition, 1 case had a history of RD after head trauma and in remaining 3 cases the cause for the RD could not be identified.

Interestingly, Vitreous hemorrhage was seen in 39 (19.3%) participants in association with DR (25 cases), ARMD (11 cases)

Table 1. Ophthalmological evaluation of the studied population in relation to their ages and genders. The data are shown as numbers [prevalence% (95% CI)].

Groups	Normal or Properly corrected Low vision	VI			Unilateral blindness	Total
		Blindness	Unilateral DOVA	Unilateral blindness		
Gender	M	388 [40.6(37.5-43.8)]	31 [3 (2.2-4.6)]	8 [0.8 (0.4-1.6)]	62 [6.5 (5-8.2)]	498 (52%)
	F	356 [37.2(34.2-40.4)]	33 [3.5 (2.4-4.8)]	9 [0.9 (0.4-1.8)]	41 [4.3(3.1-5.8)]	458 (48%)
Age	12 - 30 Y	283 [29.6(26.7-32.6)]	13 [1.3 (0.7-2.3)]	3 [0.3 (0.1-0.9)]	41 [4.3(3.1-5.8)]	352 (36.8%)
	31-40 Y	188 [19.7(17.2-22.3)]	7 [0.7(0.3-1.5)]	4 [0.4(0.1-1.1)]	26 [2.7 (1.8-4)]	201 (21 %)
	41-50 Y	190 [19.9(17.4-22.5)]	9 [0.9 (0.4-1.8)]	5 [0.5(0.2-1.2)]	18 [1.9(1.1-3)]	204 (21.3%)
	>50 Y	83 [8.7(7-10.6)]	35 [3.7 (2.6-5.1)]	5 [0.5(0.2-1.2)]	18 [1.9(1.1-3)]	199 (20.8%)
Totals	744 [77.8(75.1-80.4)]	64 [6.7(5.2-8.5)]	17 [1.8 (1-2.8)]	103 [10.8 (8.9-12.9)]	956 (100%)	

Abbreviations: CI: Confidence interval; DOVA: Diminution of visual acuity; F: Female; M: Male; VI: Visual impairment.

Table 4. PSEDs in relation to the ages and genders.

Groups	DR	ARMD	OA	RD	Total	
Gender	M	29 (45.3%)	9 (47.4%)	7 (45.75%)	7 (70%)	52 (47.7%)
	F	35 (54.7%)	10 (52.6%)	9 (56.25%)	3 (30%)	57 (52.3%)
Age	12- 30 Y	3 (4.7%)	-	3 (18.75%)	2 (20%)	8 (7.3%)
	31-40 Y	12 (18.7%)	-	3 (18.75%)	3 (30%)	18 (16.5%)
	41-50 Y	25 (39%)	2 (10.6%)	4 (25%)	2 (20%)	33 (30.3%)
	>50 Y	34 (53%)	17 (89.4%)	6 (37.5%)	3 (30%)	60 (55%)
	Totals	64 (100%)	19 (100%)	16 (100%)	10 (100%)	109 (100%)

Abbreviations: ARMD: Age- related macular degeneration; DR: Diabetic retinopathy; F: Female; M: Male; OA: Optic atrophy; PSED: Posterior segment eye diseases; RD: Retinal detachment.

and RD (3 cases). Vitreous hemorrhage alone was not seen in any of the participants.

Discussion

To the best of our knowledge, this is the first study focused on the prevalence of posterior segment eye diseases in cases of VI and DOVA in Saudi Arabia. The study was conducted in Arar city which is the capital of the Northern Border Region of Saudi Arabia. Nine hundred and fifty-six subjects were enrolled in the study. Prevalence of VI was estimated to be 8.4%. Low vision was found in 6.7% and blindness in 1.8% cases. While other studies in other regions in Saudi Arabia have reported prevalence of VI ranging from 7.8% to 13.9% and blindness from 0.7% to 1.5% [10-12]. Furthermore, the current study prevalence of blindness is higher than the prevalence reported in nearby countries which ranged from 0.7% to 1.1% [13]. While the higher prevalence of blindness was estimated in other countries such as Pakistan (3.4%) [14] and Upper Egypt (9.3%) [15] among the studied populations.

Unilateral DOVA was estimated in 103 (10%) participants of the current study. The prevalence of unilateral DOVA was reported to be 7.3% in Australia [16] and only 2.57% in Pakistan [17]. From these previous numbers, it is clear that the prevalence of VI and blindness is a reflection to the planned health care system in the studied locations as well as the population awareness and attitude towards the available ophthalmic healthcare services and the importance of the periodic check-up. In addition, the used examination methods and definitions of VI are expected to affect the outcome results.

Interestingly, the gender difference did not affect the distribution of VI and PSEDs in the studied population. This is different from the previous studies as by al-Shaalin et al. (2011) [10], by Dimitrov et al. (2003) [16], and McCarthy et al. (2000) [18], which showed higher prevalence of VI among females than males due to a longer life expectancies with more susceptibility to age-related visual problems. However, we were keen in our study to choose well- matched groups of both genders in the studied different age groups. While ages of the studied population significantly affect the VA and PSEDs of the studied population with more VI in elderly as DR is more prevalent with longer years of diabetes. Also, ARMD is mainly seen in ages over 50 years.

The current study showed that diabetic retinopathy (13.2% cases) was the commonest PSED diagnosed in cases of VI and DOVA. The higher incidence of DR among studied cases is ex-

pected due to a very high prevalence of diabetes in Saudi Arabia. The prevalence of DM, which is an alarming public global health problem with its related complications as retinopathy, nephropathy, and neuropathy, was estimated to be 30% in Saudi Arabia [19]. The current data about DR is in accordance with other previously published data in Saudi Arabia as by Hajar et al. (2015) [20] who have estimated a prevalence of DR among the general population to be around 5-6%.

Vitreous hemorrhages were found in 39 subjects enrolled in the study. Most cases were found as a complication of the proliferative diabetic DR and wet forms of ARMD.

In the current study, the commonest cause of OA was glaucoma which is different from Mbekeanis et al. (2017) [21], who stated that tumors are the commonest causes of OA in 62.2% of their studied cases, while in the present study, history of tumors was found only in 16% of cases. The general prevalence of vitreous hemorrhage, OA and RD were not reported in the previous literature.

The present findings are important as they highlight, for the first time in Saudi Arabia, the prevalence of the PSEDs and their attribution to VI. Secondly, the study shows that we need the support of the culture of periodic ophthalmic screening of the population which is expected to improve detection of any visual ailment in the early stages with better-expected correction especially for cases of unilateral DOVA which are usually unnoticed by the patient. Most cases of UDOVA were first discovered during the screening phase of this study. Thirdly, the current data attract the attention to follow up of diabetics by the regular ophthalmic evaluation and timely proper intervention for cases of DR. Early diagnosis and proper management of glaucoma can reduce the prevalence of OA. Application of modern surgical techniques for cataracts should reduce the risk of posterior segment complications like RD and vitreous hemorrhages [22].

Conclusion

Visual impairment is a major global health problem with negative drawbacks in society. Posterior segment eye diseases are common among the cases with visual problems. Diabetic retinopathy was found to be the commonest PSED among the studied population in Arar city, followed by ARMD, OA, and RD. Proper follow up of diabetics by regular ophthalmic evaluation and proper intervention for cases of DR can reduce the burden of visual impairment. Early diagnosis and proper management of glaucoma can markedly reduce the prevalence of OA. In addition, modern techniques in cataract surgeries can reduce such the posterior segment complications as RD and vitreous hemorrhages.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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